DESCRIPTION OF *RETUSA CHRYSOMA* BURN SP. NOV. (OPISTHOBRANCHIA) AND ITS FOOD RESOURCES FROM CORNER INLET, VICTORIA

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Abstract

Retusa chrysoma Burn sp. nov. is described from Corner Inlet, Victoria, and compared with other species reported from the Victorian coastline. Gizzard contents show selective food preferences for foraminifera and juveniles of the air breathing gastropod *Salinator fragilis* (Lamarck, 1822).

Introduction

Little is known anatomically of the shell-bearing opisthobranch molluscs of Victoria. Similarly, little is known of their food resources and selective preferences. Foraminifera are believed to form wholly or part of the food of several species of retusid opisthobranchs (Bacescu and Caraion 1956, Marcus and Marcus 1969, Moore 1961, Morton 1958, Rudman 1971), but the overall part they play in the marine food-energy cycle is poorly known (Lipps and Valentine 1970).

In order to study Australian species/food resources, we have examined a new species of *Retusa* collected by one of us (K.N.B.) at Corner Inlet, Victoria. The description of *Retusa chrysoma* has been prepared by the first author (R.B.), the analysis of the food resources by the second author (K.N.B.).

The type series of *Retusa chrysoma* and a series of foraminiferans from the gizzard contents, mounted on slides, have been presented to the National Museum of Victoria, Melbourne. The first author (R.B.) expresses his gratitude to the Science and Industry Endowment Fund, C.S.I.R.O., for continued support of this and other research on Australian opisthobranch molluscs.

Systematic Description

Order Cephalaspidea

Superfamily Bullacea

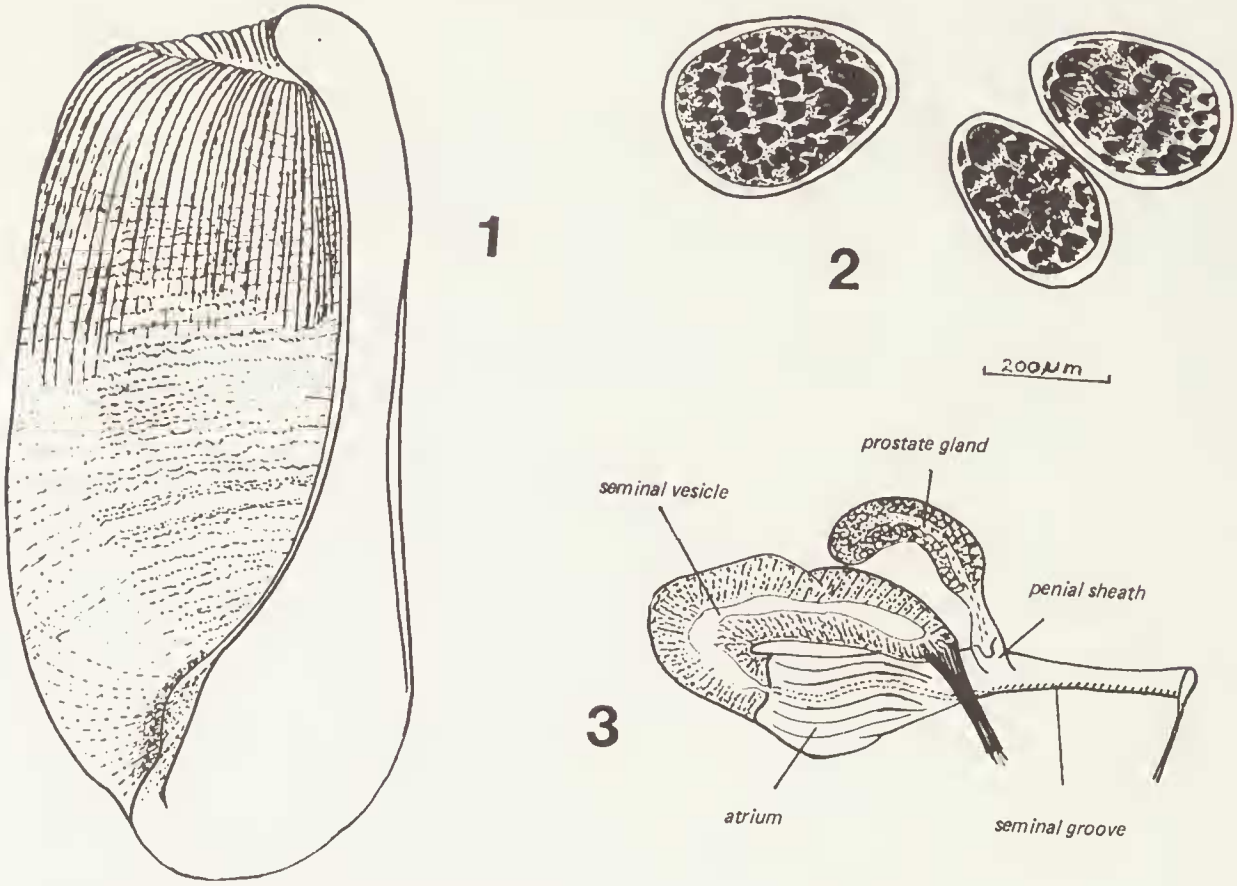
Family Retusidae

Retusa chrysoma Burn sp. nov.

Figures 1-3

Description. Shell (Fig. 1) small, cylindrical, rounded anteriorly, obliquely truncate posteriorly. Colour pale yellow, thin periostracum golden yellow. Sculpture, faint growth lines at anterior end develop into raised riblets on posterior third, riblets passing obliquely over shoulder into vertex; encircled by fine, variably spaced, wavy lines, less noticeable posteriorly where the riblets are strongest. Aperture anteriorly pyriform, medially narrow and slightly constricted, posteriorly rising above the last whorl and inclined towards the axis. Columella thickened, with a nearly vertical plait rising at mid-length, with a broad reflexion behind the plait. Spire deeply sunk, shoulder of the preceding whorl visible, sculptured by oblique riblets descending to a large, smooth, papillary protoconch. Dimensions (length x breadth): Holotype 3·06 x 1·425 mm, largest paratype 3·0 x 1·5 mm, smallest paratype 1·425 x 0·78 mm, figured specimen (dry shell) 2·7 x 1·3 mm.

Animal cream; head quadrate, broader than long, with a pair of broad, thin lobes posteriorly; yellowish Hancock's organs in furrow between head and foot and close to mouth, strongly developed, thickened, harder than the surrounding skin, each with 3 or 4 shallow transverse folds; foot short, rounded anteriorly, truncate posteriorly. Gastral plates (Fig. 2) with many dark tubercles of various sizes, tubercles largest and highest posteriorly; largest plate convex on inner face, smaller plates concave. Male copulatory organ (Fig. 3) on right side of oesophagus; atrium long, dilated entally with folded walls, ciliated seminal groove to opening of elongate seminal



Figs. 1–3—*Retusa chrysoma* Burn sp. nov.
1, Shell. 2, Gastral plates. 3, Male copulatory organ. (Figs. 2-3 drawn to same scale).

vesicle, retractor muscle attached to end of vesicle; prostrate gland shorter than vesicle, filled with shining cells, narrower near atrium and with short papilla in penial sheath.

Material examined. From *Zostera* and mud flats on N. side of Rocky Point reef, at E. end of Bluff Road, Yanakie, Corner Inlet, Viet., collected by K. N. Bell, 11 April 1971, seven specimens (NMV F27490); 1 April 1972, eight specimens (Holotype NMV F27488 and seven paratypes NMV F27489). The specimens were obtained by sieving the top 1 cm of the substrate at mid-tide level. Other opisthobranchs inhabiting the same biotope were *Tornatina* cf. *apicina* (Gould, 1859) and *Cylichnatys* sp. nov. (Scaphandridae), and *Liloa brevis* (Quoy and Gaimard, 1833) (Atyidae).

Etymology. Chrysoma Gk. = a gold object, vessel, plate, dress; in reference to the colour of the shell.

Discussion. The authors wholeheartedly agree with Valentine's comment (1965, p. 42) that "The forms of *Cylichnina* (i.e. *Retusa*) living in SE. Australia merit review." Examination of large series of dry shells from different localities lead us to believe that little can be achieved by this method, yet, hitherto, all Australian records of retusids and other shelled opisthobranchs have been based upon dead shells. The small amount of material collected alive that we have so far examined suggests that the animal has much importance for separating one species from the next, and that there are many local species.

In dealing with retusids of SE. Australia, we follow Rudman (1971, p. 192) in allocating those species with tubercles on the gastral

plates to *Retusa* Brown, 1827, and those with smooth gastral plates to *Relichna* Rudman, 1971. The type species of *Cylichnina* Monterosato, 1884, *umbilicata* (Montagu, 1804), has tuberculate gastral plates (Pilsbry, 1893, p. 204, pl. 60, fig. 8) and is no longer held separate from *Retusa* (Lemche, 1948, p. 50). *Cylichnina* must therefore be expunged from Australian faunal lists and replaced by *Retusa*.

There are only four species of *Retusa* reported from the Victorian coastline (Macpherson and Gabriel 1962, p. 243). *R. amphizosta* (Watson, 1886) was recorded from Portsea by Gatliff and Gabriel (1908, p. 384). Hedley (1914, p. 753) suggested their specimens might be his *R. iredaleana* (1914, p. 752). After study of a British Museum (Natural History) photograph of one of the three syntypes of *Bulla* (*Cylichna*) *pygmaea* A. Adams, 1854, from Port Lincoln, S. Aust., we are inclined to think that *R. iredaleana* from Middle Harbour, Sydney Harbour, N.S.W., and Gatliff and Gabriel's specimens are referable to *R. pygmaea*. *Cylichnina atkinsoni* (Tenison Woods, 1875) has tuberculate gastral plates (personal observations) and must be transferred to *Retusa* The *C. pygmaea* of Macpherson and Gabriel (1962, p. 243) may refer to another, apparently new, species of *Retusa* that we have from Port Phillip Bay and Shallow Inlet, Vict. It differs from true *R. pygmaea* in the narrower shape of the shell and greater inclination of the posterior lip of the aperture. *R. sculpta* (Gatliff and Gabriel, 1913) has both spiral and axial sculpture, and may be a juvenile form.

The new species, *R. chrysoma*, is distinguished from each of the above species by the riblets of the posterior third of the shell and the fine wavy spiral lines on the remainder of the surface. From species for which the animal is known, *R. chrysoma* differs in the density of the tubercles on the gastral plates.

Gizzard Contents

Live specimens of *Retusa chrysoma* Burn were collected and preserved in 70% alcohol for later study. After carefully fracturing each shell, the gizzard was dissected out, and the contents removed.

To see if any selection for food had occurred a sample of the sediment of the biotope was collected and placed in 70% alcohol. This sample was later washed to remove any preservative, placed in rose Bengal stain (1 g/l solution) for one hour, washed and dried. Foraminifera were concentrated by flotation in carbon tetrachloride. The rose Bengal stains the protoplasm of living specimens a deep red (Walton 1952).

Results

The gizzard contents of 11 specimens of *R. chrysoma* consisted of 43 specimens of foraminifera belonging to six species (Table 1) and nine specimens of juveniles of *Salinator fragilis* (Lamarck, 1822). Also present were 17 chitinous opercula which appear to be identical with the operculum of *S. fragilis*. Table 2 shows the contents of each specimen of *R. chrysoma*. From the sediment sample 15 species of living foraminifera were recovered (Table 3).

Although the number of specimens studied is small, there is evidence for selection in their food intake. This is most clearly seen with *Quinquiloculina seminula* which constitutes only 7·5% of the foraminiferal fauna but 28% of the foraminiferal food intake. The higher percentages of the food intake of *Elphidium simplex, E. advenum depressulum* and *Ammonia aoteanus* may not be significant considering the small numbers involved. The lack of any specimens of *Q. seminula jugosa* as food shows a definite selection against this species. The lack of other foraminiferal

TABLE 1

Foraminifera in the gizzard of *R. chrysoma*

Foraminiferan	No. of Specimens	%	% in sediment sample
Amnotium salsum	18	42	62
Quinquiloculina seminula	12	28	7.5
Elphidium simplex	5	12	4
E. advenum depressulum	4	9	6
Ammonia aoteanus	3	7.5	2.5
Brizalina cacozela	1	2.5	7.5

TABLE 2
Number of Foraminifera and Mollusca in *R. chrysoma* Specimens

Gizzard contents	a	b	c	d	e	f	g	h	j	k	l	Total
A. salsum	1	4		1	1	6	1	2	1	1		18
Q. seminula			1	2		5	1		3			12
E. simplex					1	2	1		1			5
E. advenum depressulum	2		1								1	4
A. aoteanus			2			1						3
B. cacozela			1									1
Salinator fragilis	1	1		2			1		2	1	1	9
Opercula	2	2			2		1	6			4	17
Total	6	7	5	5	4	14	5	8	7	2	6	

species is most likely due to their normal infrequeney in the sediment.

More evidence of food selection is shown by the prcsenee of *Salinator fragilis*. Nine specimens and 17 separate opercula were found indieating that this gastropod forms a major food source of *R. chrysoma*.

None of the speeimens, foraminiferan or molluscan, showed any evidence of crushing from the gastral plates. This is in agreement with the observation of Mareus and Marcus (1969, p. 7) upon the crop eontcnts of *Retusa sosa* Marcus and Mareus. In the present case, however, thc gizzard eontents all showed solution effeets. Several *Ammotium salsum* were very soft suggesting that the eementing material between the sand grains had been removed, although they rctained their normal shape. One *S. fragilis* had had the calcareous shell almost entirely dissolved but again had retained its normal shape. No separate sand grains were found in the intestines as would be expeeted from the erushing of arenaceous foraminifera. This indicates that the food is obtained by dissolving of the foraminiferal tests and molluscan shells and slow ingestion of the viseeral masses. Although the gastral plates may act as a sieve as suggested by Mareus and Marcus (1969, p. 7) we prefer to eonsider that they act in the nature of a viee, holding the food firmly in place as the digestive processes take place. In this respect *R. chrysoma* differs from *Relichna* as Rudman (1971) found evidenee for crushing of foraminiferal tcsts by the gastral plates in *Relichna murdochi* (Suter, 1913).

Of the four speeies of opisthobranch present in the biotope only *R. chrysoma* had foraminifera or molluscs in the gizzard.

TABLE 3
Frcqueney of Live Foraminifera in sediment

Reophax sp.	1·0%
Protoschista findens	2·0%
Ammotium salsum	62·0%
Ammobaculites sp.	0·6%
Trochammina inflata	0·6%
Textularia cf. *agglutinans*	0·6%
Quinqueloculina seminula	7·5%
Q. seminula jugosa	9·0%
Spirillina vivipara	0·6%
Brizalina cacozela	7·5%
Ammonia aoteanus	2·5%
Rosalina bradyi	1·0%
Elphidium advenum	0·6%
E. advenum depressulum	6·0%
E. simplex	4·0%

Foraminiferal Reference List

The foraminifera identified are arranged in alphabetical order giving original reference and several more reeent references eoneerned with the Australian region.

Ammobaculites sp. One small specimen is referred to this genus.

Ammonia aoteanus (Finlay).
Strebulus aoteanus Finlay 1940, *Trans. R. Soc. N.Z.* 69 (4): 461.
Ammonia aoteanus (Finlay). Hedley, Hurdle and Burdett, 1967, *N.Z. Dep. sci. industr. Res. Bull.* 180: 47, pl. 11, fig. 4, figs. 56-60.

Ammotium salsum (Cushman and Bronnimann).
Ammobaculites salsus Cushman and Bronnimann, 1948, *Cush. Lab. foram. Res. Cont.* 24 (1): 16, pl. 3, figs. 7-9.

Brizalina cacozela (Vella).
Bolivina cacozela Vella 1957, *N.Z. geol. Surv. Pal. Bull.* 28: 33, pl. 8, figs. 162-163.

Spirillina vivipara Ehrenberg.
Spirillina vivipara Ehrenberg 1843, *Abh. preuss. Akad. Wiss.* 1841: 442, pl. 3, fig. 41.

Elphidium advenum (Cushman).
Polystomella advenum Cushman 1922, *Carnegie Inst Wash. Publ* 311: 56, pl. 9, figs. 11-12.
Elphidium advenum depressulum Cushman.
Elphidium advenum depressulum Cushman 1933, *U.S. natn. Mus. Bull.* 161 (2): 51, pl. 12, fig. 4.
Elphidium simplex Cushman.
Elphidium simplex Cushman 1933, *U.S. natn. Mus. Bull.* 161 (2): 52, pl. 12, figs. 8-9.
Protoschista findens (Parker).
Lituola findens Parker 1870 *in* Dawson, *Canadian natn. n.s.* 5:176.
Protoschista findens (Parker). Loeblich and Tappan, 1953, *Smith. Misc. Coll.* 121: 25, pl. 1, figs. 16-18.
Quinquiloculina seminula (Linne).
Serpula seminulum Linne, 1767, *Systema Naturae.*
Quinquiloculina seminulum (Linne). Graham and Militante, 1959, *Stanford Univ. Publs geol. Sci.* 6 (2): 48, pl. 6, fig. 6.
Quinquiloculina seminula jugosa Cushman.
Quinquiloculina seminula jugosa Cushman 1944, *Cush. Lab. foram. Res. Spec Publ* 12: 13, pl. 2, fig. 15.
Reophax sp. A small, tapering, globular chambered *Reophax*. This appears to be an undescribed species from shallow Victorian waters.
Rosalina bradyi (Cushman).
Discorbis globularis bradyi Cushman, 1915, *U.S. natn. Mus. Bull.* 71 (5): 12, pl. 8, fig. 1.
Rosalina bradyi (Cushman). Albani, 1968, *Cush. Fdn foram. Res. Cont.* 19 (3): 109, pl. 9, figs. 1-2, 5-6.
Textularia cf. *agglutinans* d'Orb.
Textularia agglutinans d'Orb., 1839, *Foram. Cuba,* p. 144, pl. 1, figs. 17-18, 32.
Trochammina inflata (Montagu).
Nautilus inflatus Montagu, 1808. Suppl. *Testacea Britannica.*
Trochammina inflata (Montagu). Parr, 1945, *Proc. R. Soc. Vict.* 56: 194, pl. 8, fig. 4.

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